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Ute Reservoir
Quay County, New Mexico

National Eutrophication Survey, Las Vegas, Nev.

Prepared for

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

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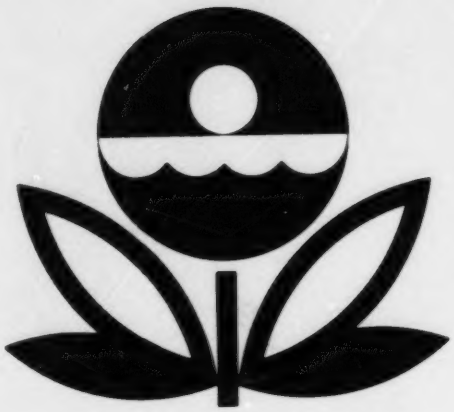

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

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REPORT
ON
UTE RESERVOIR
QUAY COUNTY
NEW MEXICO
EPA REGION VI
WORKING PAPER No. 824

WITH THE COOPERATION OF THE
NEW MEXICO ENVIRONMENTAL IMPROVEMENT AGENCY
AND THE
NEW MEXICO NATIONAL GUARD

JULY, 1977

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT ON UTE RESERVOIR

QUAY COUNTY, NEW MEXICO

EPA REGION VI

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 824

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

July 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the New Mexico Environmental Improvement Agency for professional involvement, to the New Mexico National Guard for conducting the tributary sampling phase of the Survey, and to those New Mexico wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Surveillance Section, Water Quality Division, New Mexico Environmental Improvement Agency provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

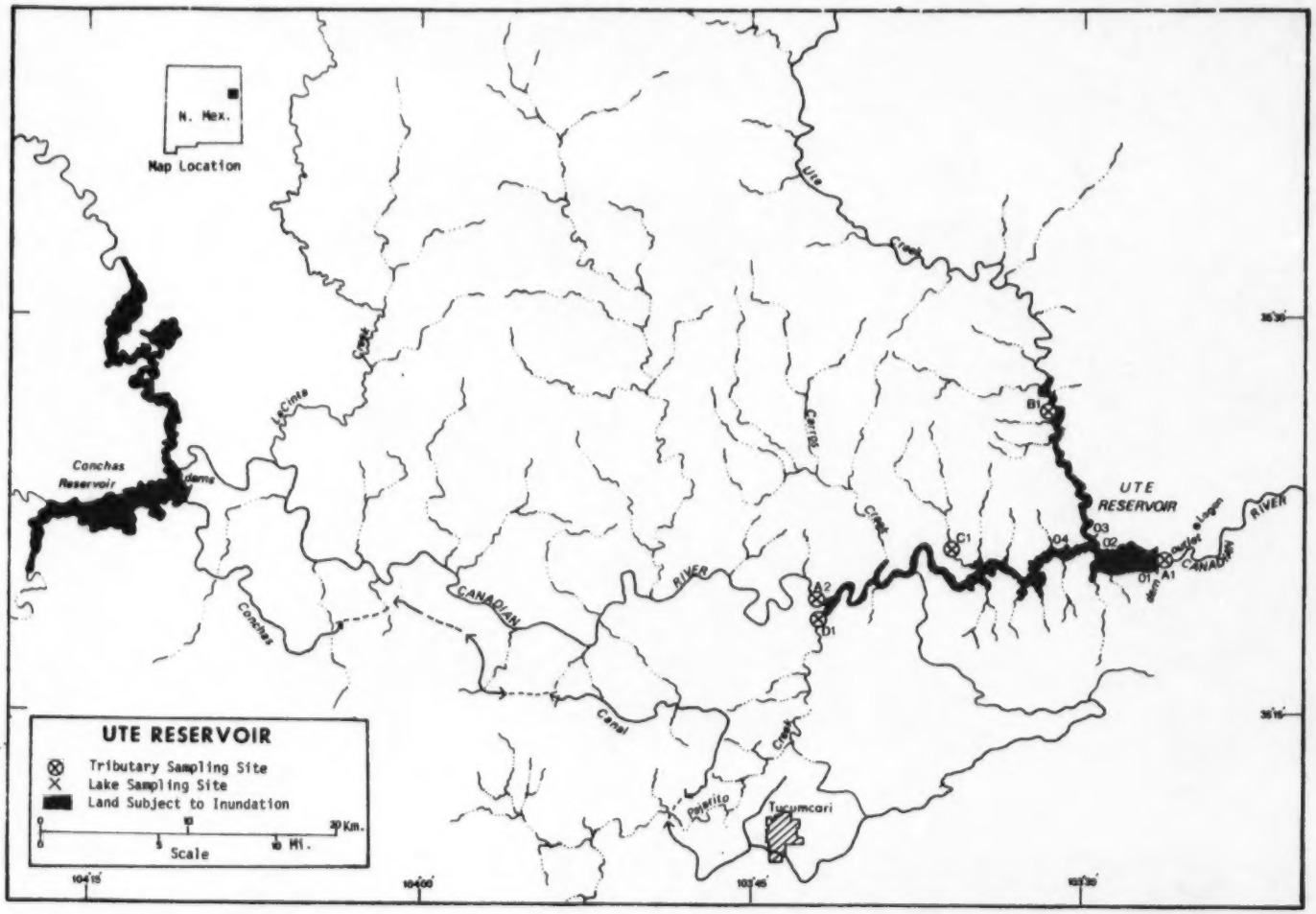
Brigadier General Franklin E. Miles, the Adjutant General of New Mexico, and Project Officer Colonel Marvin D. Bohannon, who directed the volunteer efforts of the New Mexico National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW MEXICO

LAKE NAME	COUNTY
Alamogordo Reservoir (Sumner Lake)	De Baca, Guadalupe
Bluewater Lake	Valencia, McKinley
Conchas Reservoir	San Miguel
Eagle Nest Lake	Colfax
Elephant Butte Reservoir	Sierra
El Vado Reservoir	Rio Arriba
Lake McMillan	Eddy
Ute Reservoir	Quay


N. Mex.
Map Location
Conchas Reservoir
Dams
LeCinta Canal
Conchas Canal
Ute Creek
Carrizo Creek
Canadian River
UTE RESERVOIR
Tucumcari
Quay
UTE RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Land Subject to Inundation
Scale
0
5
10 Mi.
20 Km.

REPORT ON UTE RESERVOIR, NEW MEXICO

STORET NO. 3509

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Ute Reservoir is mesotrophic. Chlorophyll a values in the lake ranged from 1.0 µg/l to 5.1 µg/l with a mean of 3.2 µg/l. Secchi disc visibility and the potential for primary productivity as measured by algal assay control yield were low. Of the nine New Mexico lakes (including Navajo Reservoir) sampled in 1975, seven had higher median total phosphorus and median inorganic nitrogen levels, and six had higher median orthophosphorus levels than Ute Reservoir.

Survey limnologists did not report any problem algal blooms or macrophyte growths during their visits to the lake. The New Mexico Environmental Improvement Agency (1974) reports that the water quality of the reservoir is generally good, but the nutrient levels in the reservoir could lead to future nuisance algal growths during low water years.

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Ute Reservoir was limited by available phosphorus during the sample collection times (05/02/75, 10/03/75). Lake data suggest primary limitation by nitrogen in the spring and summer and by phosphorus in the fall.

C. Nutrient Controllability:

1. Point sources -

There were no known point sources impacting Ute Reservoir during the sampling year.

The estimated annual phosphorus loading of 0.66 g $P/m^2/yr$ is greater than that proposed by Vollenweider (1975) as a "eutrophic" loading. Actual annual loading to the reservoir may be somewhat higher than indicated; two of the tributaries draining Ute Reservoir (Canadian River, Ute Creek) were dry at most of the sample collection times and information on their true nutrient contributions to the lake budget is not available at present. Furthermore, heavy recreational use of the reservoir may result in nutrient loading to the lake not accounted for in this report (New Mexico Water Quality Control Commission, 1975). In light of this possible underestimation of nutrient contributions to Ute Reservoir, any proposed land development adjacent to the lake should be carefully evaluated as to its effect on the existing lake water quality.

2. Nonpoint sources -

Nonpoint sources, including precipitation, were estimated to have contributed all of the nutrient load to Ute Reservoir during the sampling year. The New Mexico Environmental Improvement Agency (1974) reports that nutrient enrichment in the lake is primarily a result of natural leaching of nutrients from the Upper Sonoran watershed, rather than from point sources.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry data were provided by Martin and Hanson (1966) and Tony Drypolcher (personal communication). Tributary flow data were provided by the New Mexico District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 16.79 km^2.
2. Mean depth: 8.0 meters.
3. Maximum depth; 25.0 meters.
4. Volume: 133.451 x 10^6 m^3.
5. Mean hydraulic retention time: 492 days (1.4 yr).

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area (km^2)	Mean Flow (m^3/sec)
A-2 Canadian River	21,732.7	1.59
B-1 Ute Creek	5,335.4	1.10
C-1 Romero Draw	45.3	0.03
D-1 Pajarito Creek	1,263.9	0.25
Minor tributaries and immediate drainage -	459.8	0.05
Totals	28,837.1	3.02
2. Outlet - A-1 Canadian River	28,852.6	3.14

C. Precipitation:

1. Year of sampling: 28.8 cm.
2. Mean annual: 37.6 cm.

III. LAKE WATER QUALITY SUMMARY

Ute Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from four stations on the lake and from a number of depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll *a* analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 15.8 meters at Station 01, 14.6 meters at Station 02, and 10.4 meters at Stations 03 and 04. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll *a* determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

RESERVOIR
STORET CODE 3500

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	N*	(5/ 2/75) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(8/20/75) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(10/ 3/75) S*** = 4 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	8	13.3- 13.9	13.6	0.0- 1.5	8	24.3- 25.4	24.8	0.0- 1.5	8	18.7- 19.2	19.2	0.0- 1.5
MAX DEPTH**	4	12.7- 13.6	12.9	6.7- 15.8	4	18.4- 23.3	20.5	8.2- 15.5	4	18.9- 19.7	19.0	3.0- 14.9
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	8	8.2- 8.8	8.4	0.0- 1.5	8	5.8- 7.2	7.0	0.0- 1.5	8	6.6- 7.8	6.8	0.0- 1.5
MAX DEPTH**	4	8.2- 8.4	8.2	6.7- 15.8	4	1.2- 6.0	3.3	8.2- 15.5	4	6.4- 7.1	6.8	3.0- 14.9
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	8	765.- 820.	783.	0.0- 1.5	8	1125.-1163.	1132.	0.0- 1.5	8	834.- 849.	844.	0.0- 1.5
MAX DEPTH**	4	759.- 814.	779.	6.7- 15.8	4	942.-1047.	978.	8.2- 15.5	4	838.- 847.	840.	3.0- 14.9
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	8	8.7- 8.8	8.8	0.0- 1.5	8	8.5- 8.7	8.6	0.0- 1.5	8	8.2- 8.5	8.4	0.0- 1.5
MAX DEPTH**	4	8.7- 8.8	8.8	6.7- 15.8	4	8.0- 8.6	8.4	8.2- 15.5	4	8.4- 8.5	8.5	3.0- 14.9
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	8	226.- 296.	266.	0.0- 1.5	8	244.- 296.	266.	0.0- 1.5	8	203.- 308.	288.	0.0- 1.5
MAX DEPTH**	4	224.- 276.	274.	6.7- 15.8	4	250.- 288.	273.	8.2- 15.5	4	268.- 482.	352.	3.0- 14.9
TOTAL P (MG/L)												
0.-1.5 M DEPTH	8	0.018-0.037	0.020	0.0- 1.5	8	0.010-0.026	0.019	0.0- 1.5	8	0.019-0.026	0.022	0.0- 1.5
MAX DEPTH**	4	0.020-0.054	0.023	6.7- 15.8	4	0.016-0.035	0.024	8.2- 15.5	4	0.019-0.038	0.026	3.0- 14.9
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	8	0.006-0.016	0.012	0.0- 1.5	8	0.003-0.006	0.004	0.0- 1.5	8	0.002-0.020	0.002	0.0- 1.5
MAX DEPTH**	4	0.004-0.021	0.013	6.7- 15.8	4	0.003-0.009	0.005	8.2- 15.5	4	0.002-0.003	0.002	3.0- 14.9
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	8	0.020-0.020	0.020	0.0- 1.5	8	0.020-0.020	0.020	0.0- 1.5	8	0.020-0.030	0.020	0.0- 1.5
MAX DEPTH**	4	0.020-0.030	0.020	6.7- 15.8	4	0.020-0.030	0.020	8.2- 15.5	4	0.020-0.020	0.020	3.0- 14.9
AMMONIA (MG/L)												
0.-1.5 M DEPTH	8	0.020-0.030	0.020	0.0- 1.5	8	0.020-0.020	0.020	0.0- 1.5	8	0.020-0.040	0.020	0.0- 1.5
MAX DEPTH**	4	0.020-0.040	0.025	6.7- 15.8	4	0.0 -0.120	0.030	8.2- 15.5	4	0.020-0.030	0.025	3.0- 14.9
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	8	0.200-0.400	0.300	0.0- 1.5	8	0.300-0.700	0.400	0.0- 1.5	8	0.400-0.400	0.400	0.0- 1.5
MAX DEPTH**	4	0.200-0.400	0.300	6.7- 15.8	4	0.300-0.700	0.550	8.2- 15.5	4	0.400-0.500	0.400	3.0- 14.9
SECCHI DISC (METERS)	4	1.3- 2.7	1.8		4	0.8- 1.5	1.2		4	0.8- 0.9	0.8	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/02/75	1. Chroomonas ?	490
	2. Cryptomonas	286
	3. Fragilaria	82
	4. Cyclotella	41
	Other genera	--
	Total	899
08/20/75	1. Chroomonas ?	280
	2. Synedra	224
	3. Merismopedia	224
	4. Cryptomonas	205
	5. Dactylococcopsis	149
	Other genera	298
	Total	1,380
10/03/75	1. Cryptomonas	142
	2. Synedra	85
	3. Oocystis	57
	4. Merismopedia	57
	5. Closterium	57
	Other genera	113
	Total	511

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
05/02/75	01	1.0
	02	2.0
	03	1.8
	04	1.5
08/20/75	01	3.2
	02	2.9
	03	5.0
	04	5.0
10/02,03/75	01	2.2
	02	4.3
	03	5.1
	04	4.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
a. 05/02/75			
Control	<0.005	0.045	0.2
0.05 P	<0.055	0.045	2.5
0.05 P + 1.0	<0.055	1.045	15.4
1.00 N	<0.005	1.045	0.2
b. 10/03/75			
Control	0.020	0.060	0.2
0.05 P	0.070	0.060	5.5
0.05 P + 1.0 N	0.070	1.060	19.5
1.00 N	0.020	1.060	0.2

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary productivity in Ute Reservoir was low at both sample collection times (05/02/75, 10/03/75). In the assays, the significant increase in yield over that of the control when orthophosphorus was added as well as the lack of response to the addition of nitrogen indicates phosphorus limitation. Maximum yield was achieved with the simultaneous addition of nitrogen and phosphorus.

The mean inorganic nitrogen to orthophosphorus (N/P) ratios in the lake data of 4/1 and 10/1 in the spring and summer, respectively, suggest primary limitation by nitrogen. The fall ratio of 15/1 suggests primary limitation by phosphorus (a mean N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the New Mexico National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April and May when two samples were collected. Sampling was begun in December 1974, and was completed in November 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New Mexico District Office of the USGS for the tributary sites nearest the lake.

In this report, the nutrient load for the Canadian River at Station A-1 was determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads for Romero Draw and Pajarito Creek at Stations C-1 and D-1 were calculated from their respective mean annual concentrations and mean annual flows. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $kg/km^2/year$, in Romero Draw at Station C-1 and multiplying the means by the ZZ area in km^2.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Canadian River	?	?
B-1 Ute Creek	?	?
C-1 Romero Draw	90	0.8
D-1 Pajarito Creek	9,920	88.4
b. Minor tributaries and immediate drainge (nonpoint load) -	920	8.2
c. Known municipal STP's - None		
d. Septic tanks - None known		
e. Known industrial - None		
f. Direct precipitation* -	295	2.6
Total	11,225	100.0%
2. Outputs - A-1 Canadian River	1,095	
3. Net annual P accumulation -	10,130	

*Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Canadian River	?	?
B-1 Ute Creek	?	?
C-1 Romero Draw	1,465	2.4
D-1 Pajarito Creek	26,925	44.0
b. Minor tributaries and immediate drainage (nonpoint load) -	14,715	24.0
c. Known municipal STP's - None		
d. Septic tanks - None known		
e. Known industrial - None		
f. Direct precipitation* -	18,125	29.6
Total	61,230	100.0%

2. Outputs - A-1 Canadian River 184,455

3. Net annual N export** - 123,225

*Estimated (See NES Working Paper No. 175).
**Export probably due to unknown sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Romero Draw	2	32
Pajarito Creek	8	21

E. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading (g/m^2/yr)
Estimated loading for Ute Reservoir	0.67
Vollenweider's "eutrophic" loading	0.48
Vollenweider's "oligotrophic" loading	0.24

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW MEXICO 12/16/76

LAKE CODE 3509 UTE RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 28852.6

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3509A1	28852.6	0.963	0.510	0.210	0.368	3.681	4.417	6.060	9.883	6.570	4.049	0.708	0.008	3.141
3509A2	21732.7	0.878	0.425	0.122	0.105	1.444	2.662	2.209	5.805	3.115	1.586	0.595	0.001	1.588
350981	5335.4	0.074	0.065	0.062	0.201	1.784	1.529	2.662	3.115	2.775	0.708	0.082	0.020	1.098
3509C1	45.3	0.0	0.001	0.002	0.005	0.048	0.003	0.164	0.062	0.042	0.015	0.002	0.0	0.029
350901	1263.9	0.006	0.018	0.021	0.059	0.340	0.142	0.906	0.736	0.510	0.178	0.018	0.005	0.248
350977	476.6	0.017	0.008	0.003	0.006	0.059	0.074	0.099	0.164	0.108	0.068	0.011	0.0	0.052

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 28852.6
SUM OF SUB-DRAINAGE AREAS = 28853.9

TOTAL FLOW IN = 35.92
TOTAL FLOW OUT = 37.43

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3509A1	12	74	0.065	7	0.065				
	1	75	0.062	4	0.068				
	2	75	0.068	1	0.068				
	3	75	0.059	1	0.068				
	4	75	0.059	13	0.074	20	0.062		
	5	75	0.059	4	0.057	15	0.057		
	6	75	0.065	7	0.062				
	7	75	0.082	12	0.045				
	8	75	0.057	25	0.051				
	9	75	0.062	13	0.062				
	10	75	0.059	4	0.059				
	11	75	0.048	24	0.057				
3509A2	12	74	0.065	7	0.0				
	1	75	0.062	4	0.0				
	2	75	0.068	1	0.0				
	3	75	0.059	1	0.0				
	4	75	0.059	5	0.0	20	0.0		
	5	75	0.059	1	0.0	4	0.0		
	6	75	0.065	7	0.0				
	7	75	0.082	12	0.057				
	8	75	0.057	23	0.0				
	9	75	0.065	13	0.0				
	10	75	0.212	4	0.0				
	11	75	0.085	24	0.057				

20

TRIBUTARY FLOW INFORMATION FOR NEW MEXICO 12/16/76

LAKE CODE 3509 UTE RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3509B1	12	74	0.0						
	1	75	0.0	4	0.0				
	2	75	0.0	1	0.0				
	3	75	0.0	1	0.0				
	4	75	0.0	5	0.0	20	0.0		
	5	75	0.001	4	0.0	15	0.0		
	6	75	0.510	7	0.0				
	7	75	0.821	12	0.566				
	8	75	0.623	23	0.0	25	0.0		
	9	75	0.022	13	0.024				
	10	75	0.0	4	0.0				
	11	75	0.0	24	0.0				
3509C1	12	74	0.0	7	0.0				
	1	75	0.0	4	0.0				
	2	75	0.0	1	0.0				
	3	75	0.0	1	0.0				
	4	75	0.0	5	0.0	20	0.0		
	5	75	0.0	4	0.0	15	0.0		
	6	75	0.001	7	0.0				
	7	75	0.051	12	0.034				
	8	75	0.012	23	0.0				
	9	75	0.000						
	10	75	0.0	4	0.0				
	11	75	0.0	24	0.0				
3509D1	12	74	0.0	7	0.0				
	1	75	0.0	4	0.0				
	2	75	0.0	1	0.0				
	3	75	0.0	1	0.0				
	4	75	0.0	5	0.0	20	0.0		
	5	75	0.0	4	0.0	15	0.0		
	6	75	0.048	7	0.0				
	7	75	0.280	12	0.193				
	8	75	0.147						
	9	75	0.005	13	0.0				
	10	75	0.0	4	0.0				
	11	75	0.0	24	0.0				
3509ZZ	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	0.0						
	5	75	0.0						
	6	75	0.045						
	7	75	0.074						
	8	75	0.057						
	9	75	0.002						
	10	75	0.0						
	11	75	0.0						

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

350901
35 20 35.0 103 26 46.0 3
UTE RESERVOIR
35037 NEW MEXICO

/TYPA/AMBNT/LAKE

11EPALES 760109 04001002
0054 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/02	09 30	0000	13.4	8.2	108	765	8.70	296	0.030	0.400	0.020K	0.006
	09 30	0005	13.3	8.2		820	8.70	246	0.030	0.300	0.020K	0.008
	09 30	0020	12.8	8.5		818	8.70	268	0.020	0.200	0.020	0.004
	09 30	0052	12.7	8.3		814	8.70	272	0.040	0.300	0.030	0.004
75/08/20	17 10	0000	25.3	6.8	60	1163	8.50	254	0.020K	0.400	0.020K	0.004
	17 10	0005	24.8	7.0		1158	8.60	296	0.020K	0.400	0.020K	0.006
	17 10	0020	23.1	6.8		1133	8.40	270	0.020K	0.400	0.020K	0.004
	17 10	0051	18.4	6.0		947	8.00	272	0.120	0.500	0.020K	0.006
75/10/03	08 55	0000	19.0	6.8	36	844	8.20	294	0.030	0.400	0.020K	0.020K
	08 55	0005	19.2	6.6		849	8.30	296	0.030	0.400	0.020K	0.002K
	08 55	0015	19.1	6.2		849	8.30	294	0.030	0.300	0.020K	0.002K
	08 55	0030	19.1	6.6		844	8.35	312	0.030	0.400	0.020K	0.003
	08 55	0049	19.0	7.0		842	8.40	342	0.030	0.400	0.020K	0.002

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/02	09 30	0000	0.028	1.0	
	09 30	0005	0.025		
	09 30	0020	0.021		
	09 30	0052	0.054		
75/08/20	17 10	0000	0.018	3.2	
	17 10	0005	0.013		
	17 10	0020	0.013		
	17 10	0051	0.016		
75/10/03	08 55	0000	0.022	2.2	
	08 55	0005	0.019		
	08 55	0015	0.018		
	08 55	0030	0.017		
	08 55	0049	0.019		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 76/12/15
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

350902
35 21 04.0 103 29 44.0 3
UTE RESERVOIR
35037 NEW MEXICO

/TYPA/AMBNT/LAKE

11EPALES 760109 04001002
0052 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/02	09 55	0000	13.6	8.5	84	775	8.75	290	0.020	0.300	0.020K	0.010
	09 55	0005	13.5	8.6		770	8.80	262	0.020	0.300	0.020K	0.016
	09 55	0015	13.4	8.2		769	8.75	310	0.030	0.300	0.020K	0.007
	09 55	0048	12.8	8.4		759	8.75	276	0.030	0.200	0.020K	0.014
75/08/20	17 25	0000	24.4	7.2	54	1137	8.50	286	0.020	0.400	0.020K	0.005
	17 25	0005	24.3	6.8		1136	8.60	256	0.020K	0.400	0.020K	0.004
	17 25	0020	23.2	6.0		1113	8.50	250	0.000R	0.500	0.020K	0.004
	17 25	0047	18.9	1.2		942	8.50	288	0.000R	0.700	0.020K	0.009
75/10/02	09 15	0000	19.2	7.2	30	844	8.40	278	0.020	0.400	0.020K	0.002K
	09 15	0005	19.2	6.8		847	8.40	282	0.040	0.400	0.020K	0.002K
	09 15	0015	19.3	7.0		846	8.45	284	0.020	0.400	0.020K	0.002K
	09 15	0030	19.3	7.0		842	8.45	264	0.020	0.500	0.020K	0.005
	09 15	0046	19.7	6.4		847	8.45	268	0.030	0.400	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/02	09 55	0000	0.018	2.0	
	09 55	0005	0.018		
	09 55	0015	0.039		
	09 55	0048	0.026		
75/08/20	17 25	0000	0.015	2.9	
	17 25	0005	0.010		
	17 25	0020	0.018		
	17 25	0047	0.031		
75/10/02	09 15	0000	0.023	4.3	
	09 15	0005	0.022		
	09 15	0015	0.020		
	09 15	0030	0.028		
	09 15	0046	0.038		

K VALUE KNOWN TO BE LESS THAN INDICATED

R VALUE INDICATES NO RESULT REPORTED

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

350903
35 21 39.0 103 29 27.0 3
UTE RESERVOIR
35037 NEW MEXICO

/TYPA/AMBNT/LAKE

11EPALES 760109 04001002
0031 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/02	10 20	0000	13.9	8.4	57	794	8.80	274	0.020	0.300	0.020K	0.014
	10 20	0005	13.7	8.8		782	8.75	256	0.020K	0.200	0.020K	0.013
	10 20	0015	13.7	8.3		786	8.75	240	0.030	0.400	0.020K	0.014
	10 20	0027	13.6	8.2		782	8.75	224	0.020	0.400	0.020K	0.013
75/08/20	17 50	0000	24.5	7.2	30	1126	8.60	266	0.020K	0.700	0.020K	0.005
	17 50	0005	25.2	7.0		1127	8.65	280	0.020K	0.600	0.020K	0.004
	17 50	0015	24.5	6.8		1113	8.65	276	0.020K	0.600	0.020K	0.006
	17 50	0027	23.3	5.4		1047	8.60	274	0.020K	0.600	0.030	0.003
75/10/03	08 30	0000	19.2	7.8	36	834	8.50	203	0.020K	0.400	0.020K	0.002
	08 30	0005	19.2	7.1		843	8.50	262	0.020K	0.400	0.030	0.002K
	08 30	0015	19.2	7.2		843	8.50	284	0.020K	0.400	0.020K	0.002K
	08 30	0034	19.0	6.6		838	8.50	482	0.020K	0.400	0.020K	0.002K

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/05/02	10 20	0000	0.020	1.8	
	10 20	0005	0.021		
	10 20	0015	0.021		
	10 20	0027	0.020		
75/08/20	17 50	0000	0.020	5.0	
	17 50	0005	0.021		
	17 50	0015	0.018		
	17 50	0027	0.017		
75/10/03	08 30	0000	0.026	5.1	
	08 30	0005	0.022		
	08 30	0015	0.022		
	08 30	0034	0.030		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

350904
35 21 08.0 103 40 56.0 3
UTE RESERVOIR
35037 NEW MEXICO

/TYPA/AMBNT/LAKE

11EPALES 760109 04001002
0026 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/02	10	15 0000	13.8	8.6	50	789	8.75	226	0.020	0.300	0.020K	0.012
	10	15 0005	13.6	8.4		784	8.80	270	0.020	0.300	0.020K	0.013
	10	15 0015	13.2	8.4		780	8.75	254	0.030	0.300	0.020K	0.012
	10	15 0022	13.1	8.2		775	8.75	276	0.020	0.300	0.020K	0.021
75/08/20	17	55 0000	24.9	5.8	40	1125	8.65	244	0.020K	0.300	0.020K	0.004
	17	55 0005	25.4	7.0		1126	8.70	266	0.020K	0.300	0.020K	0.003
	17	55 0015	25.1	6.6		1122	8.60	258	0.020K	0.300	0.020K	0.002
	17	55 0034	22.1	1.2		1008	8.25	250	0.040	0.300	0.020K	0.004
75/10/02	09	35 0000	18.7	6.8	30	839	8.55	308	0.020K	0.400	0.020K	0.002
	09	35 0005	18.9	6.6		840	8.55	294	0.020K	0.400	0.020K	0.003
	09	35 0010	18.9	7.1		838	8.55	362	0.020K	0.500	0.020K	0.002

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/05/02	10	15 0000	0.018	1.5	
	10	15 0005	0.037		
	10	15 0015	0.019		
	10	15 0022	0.021		
75/08/20	17	55 0000	0.026	5.0	
	17	55 0005	0.026		
	17	55 0015	0.029		
	17	55 0034	0.035		
75/10/02	09	35 0000	0.022	4.9	
	09	35 0005	0.020		
	09	35 0010	0.022		

K VALUE KNOWN TO BE LESS THAN INDICATED

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

3509A1
35 20 40.0 102 26 40.0 4
CANADIAN RIVER
35 15 LOGAN
O/UTE RESERVOIR 101291
8NK BELOW DAM 3 MI SW OF LOGAN
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/12/07	15	50	0.310	0.500	0.015	0.005K	0.010K
75/01/04	10	10	0.160	1.000	0.032	0.009	0.010
75/02/01	10	10	0.208	1.200	0.016	0.011	0.011
75/03/01	10	00	0.115	3.465	0.040	0.005K	0.010K
75/04/13	09	45	0.025	2.400	0.025		
75/04/20	08	45	0.125	2.200	0.055	0.005K	0.010K
75/05/04	08	33	0.130	1.300	0.020	0.005K	0.010K
75/05/15	10	30	0.175	1.400	0.020	0.005K	0.020
75/06/07	10	30	0.190	1.000	0.015	0.005K	0.010
75/07/12	09	15	0.085	0.950	0.020	0.005	0.010K
75/08/25	10	30	0.095	1.300	0.020	0.005K	0.010K
75/09/13	10	00	0.015	0.800	0.065	0.010	0.030
75/10/04	09	00	0.005	1.200	0.020	0.010	0.030
75/11/24	09	30	0.125	0.500	0.210	0.005K	0.010K

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

3509A2
35 19 20.0 103 41 55.0 4
CANADIAN RIVER
35 7.5 BASCOM CAMP
T/UTE RESERVOIR 101291
BNK AT FORD 1 MI N OF BASCOM CAMP
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/07/12	12 00		0.830		0.115	0.165	
75/09/13	11 30		0.690		0.015	0.040	3.300
75/11/24	12 01		0.860		0.030	0.125	7.700

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

3509B1
35 26 18.0 103 31 31.0 4
UTE CREEK
35 7.5 MONTESITO
T/UTE RESERVOIR 101291
BNK 1.8 MI ENE OF DUCK POND TANK
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/07/12	10	15	0.440	1.450	0.025	0.055	0.300
75/09/13	10	15	0.230		0.010	0.030	
75/10/04	10	30	0.005	0.600	0.010	0.010	0.050

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

3509C1
35 21 10.0 103 35 58.0 4
ROMERO DRAW
35 7.5 HUDSON
T/UTE RESERVOIR 101291
DRT RD BRDG .5 MI SE OF OCHENTA TANK
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/12/07	16	05	0.064	0.600	0.025	0.005K	0.010
75/01/04	11	10	0.416	3.250	0.084	0.015	0.032
75/02/01	11	30	0.155	1.400	0.008	0.005	0.040
75/03/01	11	15	0.070	1.450	0.035	0.005K	0.010K
75/05/04	10	00	0.015	0.500	0.095	0.015	0.090
75/07/12	11	30	0.310	1.500	0.020	0.037	0.210
75/11/24	11	20	0.320	0.800	0.030	0.045	0.180

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 76/12/16
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

350901
35 18 40.0 103 41 55.0 4
PAJARITO CREEK
35 7.5 BASCOM CAMP
T/UTE RESERVOIR 101291
BNK AT FORD ON RD .75 MI S OF BASCOM CMP
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/12/07	13 55		1.280	3.300	0.900	1.500	1.600
75/01/04	12 10		0.790	3.600	1.320	0.957	1.300
75/02/01	12 30		0.920	3.900	1.240	1.420	1.550
75/03/01	12 30		1.300	7.000	0.950	1.500	2.400
75/04/05	12 10		0.095	0.950	0.075	0.010	0.080
75/04/20	10 55		0.005	1.850	0.040	0.440	0.870
75/05/04	10 50		0.005	1.500	0.035	0.894	0.894
75/05/15	13 20		0.010	1.400	0.025	1.250	1.300
75/06/07	13 18		0.010	2.400	0.045	1.200	1.250
75/07/12	12 30		0.700		0.035	0.220	
75/08/25	12 45		0.025	3.900	0.040	0.890	1.250
75/09/13	12 30		0.025	3.300	0.050	0.900	1.350
75/10/04	13 30		0.010		0.015	0.015	
75/11/24	09 45		0.730		0.035	0.230	

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1975

STATE OF NEW MEXICO

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of New Mexico lakes sampled are presented to allow direct comparison of the ranking, by parameter, of each lake relative to the others. Median total phosphorus, median inorganic nitrogen and median dissolved orthophosphorus levels are expressed in mg/l. Chlorophyll a values are expressed in µg/l. To maintain consistent rank order with the preceding parameters, the mean Secchi disc depth, in inches, is subtracted from 500. Similarly, minimum dissolved oxygen values are subtracted from 15 to create table entries.

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0812	NAVAJO RESERVOIR	0.025	0.130	420.928	2.164	11.200	0.009
3501	ALAMOGORDO	0.025	0.050	469.667	5.867	10.600	0.003
3502	BLUE WATER LAKE	0.036	0.140	480.125	3.867	11.400	0.012
3503	CONCHAS RESERVOIR	0.020	0.040	451.833	3.275	14.400	0.004
3504	EAGLE NEST LAKE	0.181	0.070	455.750	13.357	14.400	0.132
3505	ELEPHANT BUTTE RESERVOIR	0.083	0.110	475.750	6.758	14.200	0.052
3506	EL VADO RESERVOIR	0.034	0.140	466.444	2.189	12.600	0.014
3507	LAKE MACMILLAN	0.097	0.045	489.778	14.133	10.100	0.009
3509	UTE RESERVOIR	0.021	0.040	448.750	3.242	13.800	0.004

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0812	NAVAJO RESERVOIR	63 (5)	25 (2)	100 (8)	100 (8)	75 (6)	56 (4)
3501	ALAMOGORDO	75 (6)	63 (5)	38 (3)	38 (3)	88 (7)	100 (8)
3502	BLUE WATER LAKE	38 (3)	6 (0)	13 (1)	50 (4)	63 (5)	38 (3)
3503	CONCHAS RESERVOIR	100 (8)	94 (7)	75 (6)	63 (5)	6 (0)	81 (6)
3504	EAGLE NEST LAKE	0 (0)	50 (4)	63 (5)	13 (1)	6 (0)	0 (0)
3505	ELEPHANT BUTTE RESERVOIR	25 (2)	38 (3)	25 (2)	25 (2)	25 (2)	13 (1)
3506	EL VADO RESERVOIR	50 (4)	6 (0)	50 (4)	88 (7)	50 (4)	25 (2)
3507	LAKE MACMILLAN	13 (1)	75 (6)	0 (0)	0 (0)	100 (8)	56 (4)
3509	UTE RESERVOIR	88 (7)	94 (7)	88 (7)	75 (6)	38 (3)	81 (6)